Lesson 1

Electric Charge

Focus Question

Why does rubbing your shoes on the carpet lead to a shock when you touch a metal door knob?

New Vocabulary

electrostatics

neutral

insulator

conductor

Review Vocabulary

plasma: a gas-like, fluid state of matter made up of negatively charged electrons and positively charged ions that can conduct electric charge; makes up most of the matter in the universe, such as stars

Evidence of Charge

- **Electrostatics** is the study of electric charges that can be collected and held in one place.
- Over the years, scientists have determined that there are two types of electric charges. Benjamin Franklin called them positive and negative charges.
  - Two objects with ***like*** charges always repel each other.
  - Two objects with ***unlike*** charges always attract each other.

Evidence of Charge

- If you rub your hair with a balloon, it will stand on end because of the electrostatic force between your hair and the oppositely charged balloon.

A Microscopic View of Charge

- All materials contain light, negatively charged particles called electrons. In addition, each atom has a massive, positively charged nucleus.
- In a **neutral** object, the amount of negative charge exactly balances the amount of positive charge.
- With the addition of energy, the outer electrons can be removed from atoms.

A Microscopic View of Charge

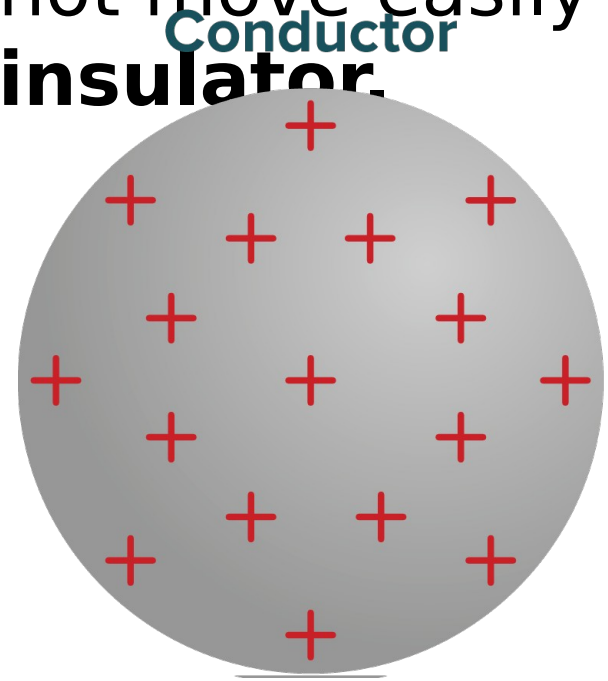
- An atom missing electrons has an overall positive charge. Consequently, any matter made of these electron-deficient atoms is positively charged.
- The freed electrons can remain unattached or become attached to other atoms, resulting in negatively charged particles.
- From a microscopic viewpoint, acquiring charge is a process of transferring electrons.
- If two neutral objects are rubbed

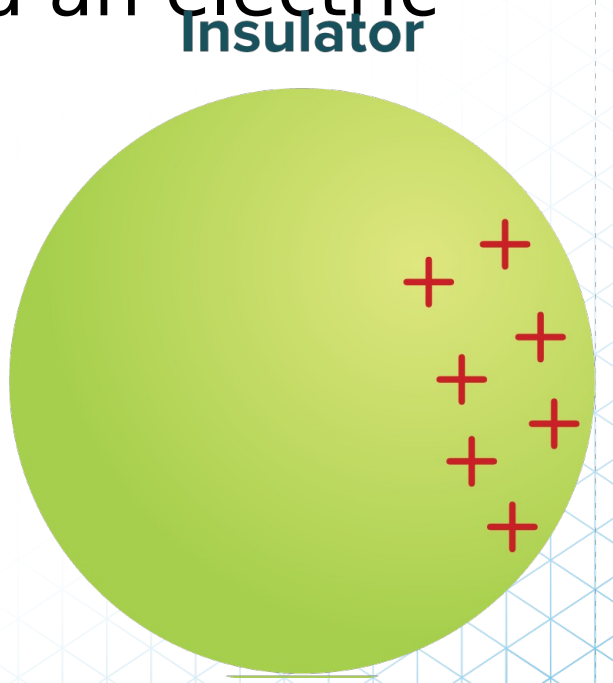
A Microscopic View of Charge

- When rubber shoes are rubbed on a wool rug, electrons are removed from the atoms in the wool and transferred to the shoes.
- The extra electrons on the rubber result in a net negative charge. The electrons missing from the wool result in a net positive charge.
- Charge is conserved. That is, individual charges are never created or destroyed. The positive and negative charges are separated through a transfer of

Conductors and Insulators

- A material that allows charges to move about easily is called an electric **conductor.**
- A material through which a charge will not move easily is called an electric **insulator.**





Conductors and Insulators

- Metals are good conductors because at least one electron on each atom can be removed easily. These electrons move freely throughout the piece of metal.
- Under certain conditions, charges move through air as if it were a conductor.

Conductors and Insulators

- The spark that jumps between your finger and a doorknob after you have rubbed your feet on a carpet discharges you. In other words, you have become neutral because the excess charges have left you.
- Similarly, lightning discharges a thundercloud. In both of these cases, air became a conductor for a brief moment. Excess charges in the cloud and on the ground are great enough to remove electrons from the molecules in

Quiz

1 Which describes the electrostatic force?

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It is repulsive between any two objects.

It is attractive between any two objects.

C It is repulsive between like charged objects.

CORRECT

It is attractive between like charged objects.

Quiz

2. Which is the best description of how a neutral object becomes positively charged?

- Positive protons that exist in a second object are transferred to the object through contact.
- Positive protons are created in the object through contact with a second object.
- Negative electrons are created and then transferred to a different object.
- **D** Negative electrons in the object are transferred to a different object.

CORRECT

Quiz

3. What is a material that allows charges to move about easily?

A conductor **CORRECT**

proton

insulator

electron

Quiz

4. Which describes an object that will repel a positively charged object?

A. an object that has had electrons transferred from it and is now negatively charged

B. an object that has had electrons transferred from it and is now positively charged

CORRECT

C. an object that has had electrons transferred to it and is now positively charged

D. an object that has had electrons transferred to it and is now negatively charged

Quiz

5. Which statement correctly identifies most metals?

They are good insulators, because each atom's electrons are very difficult to remove.

They are good conductors, because each atom's electrons are very difficult to remove.

They are good insulators, because each atom has at least one electron that can be removed easily.

D. They are good conductors, because each atom has at least one electron that can be removed easily.

CORRECT